U.S. NUCLEAR REGULATORY COMMISSION
REGION I

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Licensee:	Baltimore Gas and Electric Company Post Office Box 1475 Baltimore, Maryland 21203
Facility:	Calvert Cliffs Nuclear Power Plant Units 1 and 2
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TABLE OF CONTENTS

EXECUTIVE SUMMARY

Calvert Cliffs Nuclear Power Plant, Units 1 and 2
Inspection Report Nos. 50-317/98-04 and 50-318/98-04

This inspection reviewed Calvert Cliff's implementation of 10 CFR 50.65, the maintenance rule. The report covers a 1-week onsite inspection by regional and NRR inspectors during the week of March 30, 1998.

Maintenance

- A number of systems, structures and components (SSCs) within the scope of the Maintenance Rule (MR) were permitted to remain under 10 CFR 50.65(a)(2) when preventative maintenance failed to assure that these SSCs remained capable of performing their intended function. This is an apparent violation of 10 CFR 50.65(a)(2).

- No performance criteria had been established for the EDG building HVAC system. This is an apparent violation of 10 CFR 50.65(a)(2).

- SSC scoping was appropriately implemented and adequate technical justification was provided for those SSCs excluded from scope with one exception. A past inspection (URI 97-05-01) identified that BG&E failed to put in scope of the MR safety related emergency lighting outside the control room. This is an apparent violation of 10 CFR 50.65(b). Also, SSCs were added to the scope of the rule as identified by the licensee after initial MR implementation in July 1996 and BG&E is being credited for identifying this aspect.

- The Maintenance Rule Assessment Report 97-AR-01-EAU was comprehensive in scope and that the resultant recommendations and Issue Reports identified significant areas for improvement. However, BG&E did not act aggressively on many of these self-identified items and therefore missed opportunities to correct program deficiencies associated with the MR implementation. These deficiencies were resolving the concerns associated with the reliability index and handling repetitive functional failures in a timely manner.

- Goals and corrective actions established by BG&E for identified (a)(1) SSCs were acceptable. Additionally, the condition monitoring program for structures was found to be acceptable and SSC performance criteria were appropriately linked to the probability risk assessment (PRA).

- The program adequately implemented balancing availability and reliability. The (a)(3) evaluation reflected a thorough approach and it met the requirements of paragraph (a)(3) of the rule for balancing availability and reliability. The team also noted that despite the corrective actions associated with improving the timeliness of developing performance goals for SSCs required to be monitored under (a)(1) of the rule, several examples of excessive time periods between the identification of functional failures and the development of appropriate goals were identified by the team. Accordingly, the previous identification of this program deficiency in the (a)(3) periodic assessment coupled with the ineffective implementation of corrective actions in response to this issue represented a missed opportunity to correct an adverse finding.

- The performance of the Expert Panel to address the risk significance of systems, taking into account the limitations of PRA analyses and the identification of risk-significant systems was acceptable.

- The review of the SSC descriptions and design functions identified no discrepancies with the UFSAR. The team verified that observed plant procedures, practices, and parameters were consistent with the CCNPP UFSAR.

- BG&E's overall performance on safety assessments before taking equipment out of service was acceptable. The team determined that BG&E had implemented an effective on-line maintenance program, which appropriately considered risk in the planning, scheduling and implementation of the work weeks.

- System managers and engineers had excellent knowledge of their systems and very good knowledge of their MR responsibilities. The team determined this was a positive attribute of the program. Operations personnel had a basic understanding of the MR and their responsibilities.

Report Details

M1 Conduct of Maintenance (62706)

M1.1 Goal Setting and Monitoring (a)(1), Preventive Maintenance (a)(2)

a. Inspection Scope

The team reviewed Baltimore Gas & Electric (BG&E) program documents in order to evaluate the process established to set goals and monitor under (a)(1) and to verify that preventive maintenance had been demonstrated to be effective for systems, structures and components (SSCs) under (a)(2) of the maintenance rule. The in-depth vertical slice assessment on each SSC included a verification that goals and performance criteria were established in accordance with safety, industry-wide operation experience was taken into consideration, appropriate monitoring and trending were being performed, and that corrective actions were taken when a SSC failed to meet its goal, performance criteria, or experienced a functional failure (FF). With the responsible system managers, team members also discussed the program and performed a system walkdown to assess SSC material condition. Deep vertical slice assessments were performed on the following SSCs:

- 1A/0C Emergency Diesel Generators (a)(1)
- Auxiliary Feedwater (a)(1)
- Fire Protection (a)(1)
- Reactor Coolant Pumps and Seals (a)(1)
- H2 Recombiners (a)(1)
- H2 Analyzers (a)(1)
- 4KV Buses (a)(1)
- Compressed Air System (a)(1)
- Instrument Air System Air Amplifier (a)(1)
- Containment Spray (a)(2)
- Service Water Cooling (a)(2)
- Emergency Diesel Generator HVAC (a)(2)
- 120 VAC Vital (a)(2)
- Condenser Air Removal (a)(2)
- Structures (a)(2)

b. Observations and Findings

The team reviewed goals and corrective actions established by BG&E for identified (a)(1) SSCs and found them to be acceptable. Trending was being performed, industry experience was used, and corrective actions were commensurate with the root cause determinations.

The team determined that BG&E used a reliability index (RI) for establishing performance criteria (PC) for most electrical and some mechanical systems. The reliability index was based on a combination of unavailability and reliability factors and was appropriately linked to the PRA. The team found that the process used to determine PC was based on sensitivity studies of the impact on core damage frequency and determined this was an acceptable approach. However, the team identified the following weaknesses concerning the RI:

- The reliability index was updated quarterly on the system level by the reliability group and reported to the system managers. As a result, the reliability group had recognized that the index was limited in usefulness to the system managers (SMs) for assessing reliability and unavailability in a timely manner. Members of the expert panel agreed with this observation.

- Functional failure data which is an input to the RI could take as much as five months after identification to reach the system manager. Consequently, the SMs would review each issue report on their systems on a daily basis and make their own determination.

- Every time a FF or unavailability occurred, a new evaluation by the reliability engineering group was required, adding to the period of time between such occurrences and when the impact on the RI was reported to the SM's.

- The RI was a floating criteria against which SSC performance was measured. SSCs could move above or below the criteria with no actual quarterly changes in unavailability or reliability.

- System managers had developed alternative methods for tracking and trending data collection (report cards/precursors/engineer logs) to compensate for the difficulty in deriving meaningful data from the RI.

- The RI methodology used to assess small risk events could potentially be masked under the shadow of relatively large risk events based on sample calculations.

- The RI was defined in terms of a combination of reliabilities and unavailabilities, it did not measure these parameters individually, and therefore, degradations of reliability could potentially be masked by improvements in availability.

- For electrical systems in particular, use of the RI indices could mask degrading performance because reliability was the overriding parameter of concern with zero fault-tolerant systems. To compensate, several system managers used precursor trends to identify a potentially degrading component or train.

The team determined that the RI together with other aspects of the BG&E maintenance rule program did not allow for timely SSC cause determinations as required by a(1) when (a)(2) performance criteria was exceeded.

In addition to the examples listed below, the team noted that it took 3 to 6 months on an average to identify exceeding performance criteria using the normal BG&E's MR program procedure processes. In reviewing the BG&E maintenance rule program, the team determined that the process established did not allow the system managers (SMs) and system engineers (SEs) to make timely and independent identifications of functional failures (FF) and repetitive FFs for their responsible SSCs. The team determined that the RI together with BG&E's tedious process for identifying FF and repeat FFs had the effect of delaying the identification of exceeding (a)(2) performance criteria and the subsequent establishment of (a)(1) goals. Specifically, the team identified the following examples where BG&E failed to identify exceeding (a)(2) performance criteria and establishment of (a)(1) goals in a timely manner.

Containment Spray (CS) (System ID 061) - The system was in (a)(2) status. The team identified a repetitive functional failure which should have placed the system in an (a)(1) status in March 1997. The failures involved repetitive local leak rate test (LLRT) failures on check valve 2CKVSI-330 which occurred on March 24, 1995 and March 19, 1997 . Although the FF's were identified individually, BG&E's tracking program failed to identify them as repetitive failures.

Auxiliary Feedwater (AFW) (System ID 036A) - The system was in an (a)(1) status for unavailability and repeat functional failures. The team noted that although the system was placed in an (a)(1) status for the following four reasons, the timeliness of BG&E in identifying that requirement varied from 2.5 month s to 1.5 years.

- 23 AFW pump exceeded unavailability limit on February 27, 1997 - placed in *(a)(1) on May 8, 1997*
- 21 S/G flow train exceeded unavailability limit on February 4, 1997 - placed in *(a)(1) on May 8, 1997*
- 13 AFW pump exceeded unavailability to U2 on October 1, 1997 - placed in *(a)(1) on February 3, 1998*
- 11 AFW pump turbine bearing repeat failure on August 1996 - placed in *(a)(1) on February 3, 1998*

4KV Breakers (4KV) (System ID 004) - BG&E's review identified that the system should have been placed in (a)(1) status by March 1997 due to repetitive FFs on the 4KV breaker manual trip levers associated with the #21 and #22 low pressure safety injection pumps. BG&E did not place the system in (a)(1) until March 22,1998.

Instrument Air System Air Amplifier (IASAA) (System ID 019) - BG&E's review identified that the system should have been placed in (a)(1) status in March 1997 due to repetitive FFs. System pump IA2058 failed to start due to seal degradation on both occasions. BG&E did not place the system in (a)(1) until March 27, 1998.

Hydrogen Recombiners (H2R) (System ID 073) - BG&E's review identified that the system should have been placed in (a)(1) status in October 1997 but did not identify exceeding the unavailability performance criteria until March 25,1998. An issue report was written by licensee to address the delay and change in status.

H2 Analyzers (H2A) (System ID 038B) - BG&E's review identified that the system should have been placed in (a)(1) status in October 1997 but did not identify exceeding the unavailability performance criteria until March 25, 1998.

Considering these examples, the team determined that BG&E permitted certain SSCs within the scope of the Maintenance Rule to remain under 10 CFR 50.65(a)(2) when preventative maintenance failed to assure that these SSCs remained capable of performing their intended function. This situation was reflected in the applicable performance monitoring criteria and is an apparent violation of 10 CFR 50.65(a)(2). **(EEI 50-317(318)/98-04-01)**

Also, the team noted that delays in moving certain systems from a(2) to a(1) status were due, in part, to SM misunderstanding of the reliability index and of related responsibilities. BG&E's maintenance rule coordinator (MRC) informed the team that a goal had been established to eliminate the reliability index and establish new performance criteria for all systems within the scope of the rule by May 18, 1998. In addition, BG&E had planned to revise their maintenance rule program by May 18, 1998, to allow the SMs and SEs to play a more proactive role in determining functional failures and repeat functional failures in an effort to improve timeliness.

The team reviewed a sample of the new criteria and found it to be acceptable. However, for 19 SSCs, some performance criteria was established in terms of a "per site" rather than on a "per unit" bases. The team determined that the use of "per site" criteria could potentially mask and exceed acceptable "per unit" failure rates. The BG&E maintenance rule coordinator and his supervisor acknowledged the team's concern and stated that BG&E planned to revise these criteria by May 1, 1998 to prevent the potential masking effect.

The team determined that SSC preventive maintenance was adequate and that the material condition of the SSCs inspected was good. On walkdowns, the team found no significant or obvious deficiency which had not already been identified by BG&E and appropriate actions had been taken to initiate repairs. In addition to the previously mentioned systems, below listed SSCs were also reviewed in depth with generally positive results as indicated herein.

1A Emergency Diesel Generator Building HVAC (1A-EDG HVAC) (103) - The system was in (a)(2) and the material condition of the system was good, with few discrepancies noted. The system manager was tracking system performance on an informal and loosely documented basis, however, the team identified that no performance criteria had been developed and approved by the expert panel. Therefore, it was not possible to ascertain the appropriate MR status for this system. The inspection team concluded this is an apparent violation of 10 CFR 50.65(a)(2). (EEI 50-317(318)/98-04-02)

Reactor Coolant Pumps (RCPs) (System ID 064B) - The system was in an (a)(1) status for RCP seal degradation and failures. On September 12, 1997, Unit 1 was shut down in order to replace RCP 11B seal. The mid-cycle outage was required because the lower seal stage had failed and that the middle seal staging pressure were ready to exceed the vendor's shutdown limits of 1500 psi as a result of the degradation of the upper seal stage. The lower seal failed in August 1996 and the upper seal began to degrade on May 30, 1997. The upper seal slowly degraded until a mid-cycle outage was required in September 1997. This (a)(1) determination was addressed in IR3-009-337 which was initiated on February 26, 1998.

In addition to the above noted seal failures, the 11B RCP had experienced additional functional failures. These functional failures were related to 11B RCP tripping off line as a result of a ground over current and phase differential fault in the motor (i.e., IR1-038-020) and the 11B RCP high vibration, a subsequent plant shutdown due to failed cap screws, locking tab and suction deflector which ended up in various areas within the RCP or reactor vessel(i.e., IR1-044-256).

There were several failures of the 11B RCP motor. Accordingly, the pump's MR function to provide RCS forced flow was degraded or lost. Based on reviews of related IRs, associated corrective actions and discussions with the system manager and the maintenance rule coordinator (MRC), the team determined that the above noted failures had been appropriately captured by the licensee as functional failures. The actions of the licensee to move the RCPs into an (a)(1) status and the implementation of appropriate corrective action was determined to be appropriate by the team.

Compressed Air System (CAS) (System ID 019) - The system was in an (a)(1) status for repetitive functional failures of the 21 PA compressor total closure valve on 09/05/96 and 06/16/97. The failure was generic to the IA compressor. Therefore, both Unit 1 and Unit 2 Compressed Air Systems were moved into (a)(1) on October 22, 1997. CAS system and plant level performance criteria were revised on March 29, 1998 from the previously used RI.

Fire Protection System (FP) (System ID 013) - The system was in an (a)(1) status for falling below the acceptable performance levels during the third quarter of 1995 when the RI was exceed. The team noted that BG&E had identified the fire protection system had already exceeded its current performance criteria of <350 hours unavailability 12 fire pump/2 years, <2 run failures of 12 fire pump/2 years and no repetitive functional failures. The plant operator that accompanied the team

during the fire protection walkdown was very knowledgeable of the system MR functions and it's use within the associated emergency operating procedure (EOP) activities. During the walk down of the fire protection system, the team identified a material condition related to a lack of full thread engagement of one bolt on the bonnet area of the #11 electric fire pump check valve O-FP-105. The lack of full tread engagement had no adverse affect on the function of the valve or system and was appropriately handled through the BG&E IR program.

Service Water Cooling System (SRW) (System ID 011) - The system was in an (a)(2) status; however, the SM indicated that there were plans to move this SSC into an (a)(1) status in the near future. At the time of the inspection, the SRW system was undergoing preparation for major modifications of the system to include replacing the SRW heat exchanges. The performance criteria for the SRW system were revised on March 29, 1998 which adjusted the plant level criteria. The team noted that BG&E had identified that the SRW system had already exceeded its new performance criteria of < 100 hours single pump unavailability/pump/2 years and no repeat functional failures. One FF, identified in maintenance work order (MWO) 2199705035, related to the interface between the containment air cooler (CAN) system and the SAR system and was not appropriately included in the tracking data for the third quarter of 1997; however, this did not affect overall system performance.

Based on reviews of related IRs, MWOs, associated corrective actions and discussions with the system manager, the team determined that the above noted failures had been appropriately captured by the licensee as functional failures. The intended actions of the licensee to move the SRW system into an (a)(1) status and the implementation of appropriate corrective action was determined to be appropriate by the team.

120 Vac Vital (120VAC) (System ID 018) - The team noted that the system was in very good condition, and had recently been enhanced with the installation of new inverters. The system manager considered the use of reliability indices to be of limited value in monitoring the performance of zero-fault tolerant systems like this. The team noted that he had developed alternate methods of tracking system performance, such as the use of report cards and precursor events, which compensated for the difficulty in deriving meaningful data from the indices.

Condenser Air Removal (CAR) (System ID 043) - The team found this system's material condition to be adequate, although the system manager indicated a number of degraded conditions existed which were challenging the system's current (a)(2) status. There had been one functional failure (loss of vacuum in Unit 1, October, 1997) in the past two years. The team observed that the system manager had implemented a number of initiatives to improve system performance. The initiatives appeared to be appropriately prioritized and contained expected results and performance criteria.

1A Emergency Diesel Generator (System ID 024C) - The team found this system to be in very good material condition. However, the team noted that performance criteria had not been developed in a timely manner after the system was declared operable in 1996. BG&E is being credited with identifying this failure in Issue Report (IR) 1-061-167. The 1A EDG was currently in (a)(2).

Structures (STR) (System ID 102) - The team reviewed the structural monitoring program and determined that the program was acceptably implemented. Condition monitoring documentation was reviewed for the Condensate Storage Tank #12, 1B EDG, and 1A EDG buildings and found to be acceptable. During plant tours, several members of the team inspected other selected structures including tanks, supports, seismic wall, snubbers, and foundations and observed no previously unidentified problems.

Component Cooling Water System (CCW) (System ID 015) - This system was in an (a)(2) status. The team reviewed system performance and issue reports for the previous two years and identified no functional failures of this (a)(2) system. Preventive maintenance for CCW was acceptable.

c. Conclusions

BG&E permitted certain SSCs within the scope of the Maintenance Rule to remain under 10 CFR 50.65(a)(2) when preventative maintenance failed to assure that these SSCs remained capable of performing their intended function. This situation was reflected in the failure to meet the applicable performance criteria and is an apparent violation of 10 CFR 50.65(a)(2).

No performance criteria had been established for the EDG building HVAC system. This is an apparent violation of 10 CFR 50.65(a)(2).

With few exceptions, each of the functional failures were well known and understood by the responsible SM, had been suitably captured in the IR program, and had appropriate corrective actions instituted. The team reviewed goals and corrective actions established by BG&E for identified (a)(1) SSCs and found them to be acceptable except for the reliability index. SSC performance criteria was appropriately linked to the PRA. Additionally, the condition monitoring program for structures was found to be acceptable and the overall material condition of the SSCs walked down was good.

M1.2 Structures, Systems, and Components (SSCs) included within the Scope of the Rule

a. Inspection Scope

The team reviewed scoping documentation to determine if the appropriate SSCs were included within BG&E's maintenance rule (MR) program in accordance with 10 CFR 50.65(b). The team also reviewed the BG&E Updated Safety Analysis Report (UFSAR), Emergency Operating Procedures (EOPs), Maintenance Rule Scoping Configuration Control (EN-1-309), System Level Scoping (EN-1-301), and SSC Evaluation (ES-011).

b. Observations and Findings

The BG&E Maintenance Rule Scoping Configuration Control procedure identified the methodology for selecting SSCs that should be included within the scope of the rule. BG&E had originally identified 62 of 127 individual SSCs were within scope when the maintenance rule was implemented in July, 1996.

The BG&E System Level Scoping and SSC evaluation documents identified system boundaries and functions included within the scope of the rule for each SSC. Additionally, the BG&E MR EOP scoping basis document was used to identify the functions that were EOP related for each SSC. The team used these documents to verify BG&E's scoping and function determination decisions.

The team reviewed additional system documentation on scoping decisions for the following SSCs: auxiliary feedwater, containment spray, 1A emergency diesel generator (EDG), EDG building HVAC, 4KV buses, structures, condenser air removal, fire protection, service water cooling, 120 VAC vital, instrument air system air amplifier, reactor coolant pumps, and compressed air. Additionally, the team reviewed the expert panel (EP) meeting minutes which described the reasoning behind various scoping decisions and found that they were technically justified and were adequate overall. With the exception of the safety related emergency lighting located outside the control room, the team determined that the appropriate SSCs, as well as their functions, had been properly identified as being within scope of the maintenance rule and those excluded from scope had adequate technical justification.

The team also determined that BG&E had added 20 SSCs to the scope of the rule after initial MR implementation on July 10, 1996, which was a violation of 10 CFR 50.65(b). BG&E is being credited with self identifying this problem.

The team reviewed unresolved item URI 97-05-01 which identified during the July 1997 to October 1997 inspection period, that emergency lighting outside the control room, required for the safe shutdown of the plant, had not been properly scoped and placed within the MR. The team found that the lights have since been scoped into the MR, and determined that appropriate performance criteria and functions had been established. However, at the time of the referenced inspection, these lights were not scoped into the MR and this was not realized by CCNPP until

identified by the NRC. The team also determined that BG&E had added 20 SSCs to the scope of the rule after initial MR implementation on July 10, 1996. The inspection team determined this was a violation of 10 CFR 50.65(b). **(EEI 50-317(318)/98-04-03)**

c. Conclusions

BG&E had completed scoping in accordance with the maintenance rule and the appropriate SSCs and their functions were included in scope with the following exceptions. The NRC identified that BG&E had failed to properly scope the safety related portion of the emergency lighting system outside the control room into the MR and BG&E had added 20 SSCs to the scope after the required MR implementation date of July 10,1996 which is an apparent violation of 10 CFR 50.65(b). Except for emergency lighting, the team found that adequate technical justification was provided for those SSCs excluded from scope. However, BG&E is being credited with adding 20 SSCs to the scope after the required MR implementation date of July 10, 1996.

M1.3 Risk Ranking and Expert Panel

a. Inspection Scope

The inspectors reviewed those methods and calculations that BG&E had established for making these required safety determinations. The inspectors also reviewed the safety determinations that were made for the SSCs that were reviewed in detail during this inspection.

b. Observations and Findings

Risk ranking

The Probabilistic Risk Assessment (PRA) model used to support the Maintenance Rule (MR) for ranking risk used an updated version of the Individual Plant Examination (IPE). Plant-specific data had been incorporated into this PRA model by using Bayesian updating. BG&E developed a complete PRA model for Unit 1, and the model for Unit 2 was being developed. The Core Damage Frequency (CDF) for Unit 1 was about 4E-4/year, and for Unit 2 was about 5E-4/year. The main reason for the difference between the two was that the Emergency Diesel Generators (EDG) of Unit 2 depended on service water, while only one of the EDGs of Unit 1 did so. The risk ranking for both units was for cooling based on the model for Unit 1; BG&E stated that when the plant-specific model for Unit 2 was completed, a plant-specific ranking for each Unit would be established. The differences between the units was not expected to substantially alter the ranking, and the extension of the ranking of Unit 1 to Unit 2 was acceptable.

Risk ranking for the maintenance rule at the Calvert Cliffs Nuclear Power Plant (CCNPP) was based on importantance measures calculated from the CC PRA model. SSCs were identified and provided to the expert panel as an input to risk determinations.

Expert Panel

The team found that the Expert Panel (EP) was knowledgeable, and had members with backgrounds in maintenance (several Principal System Engineers), operations (2 active senior reactor operators (SROs) and 1 inactive reactor operators (ROs), and the Principal Engineer for the PRA group. The composition of the EP met the guidelines of Section 9.3.1 of NUMARC 93-01.

The EP used PRA input and made a final determination about the risk significance of SSCs based on expert knowledge, operating experience, and industry publications. Determinations included discussions about systems preventing or mitigating accidents other than core damage, such as containment systems, and for systems preventing or mitigating accidents in modes of operation other than full power. The EP used a risk assessment worksheet, which is an attachment to "Conduct of Plant Work Control", Administrative Procedure MN-1-202, to support their determination. Some of systems were not identified as risk-significant by the PRA evaluations supporting risk ranking, but they were added by the EP to the list of risk-significant systems. These were: Primary Containment, Containment Spray, and Fire Protection.

c. Conclusions

The identification of risk-significant systems was acceptable. Selecting a truncation level using sensitivity studies for a change in CDF as a function of truncation cut-off was acceptable.

The Expert Panel was knowledgeable and the performance of the panel in addressing the risk significance of systems and in taking into account the limitations of PRA analyses was acceptable.

M1.4 (a)(3) Periodic Evaluations and Balancing Reliability and Availability

a. Inspection Scope

The team reviewed CCNPP's periodic evaluation, Maintenance Rule Paragraph (a)(3) Periodic Assessment Report, issued February 10, 1997, which addressed the period from the third quarter of 1994 through the third quarter of 1996.

b. Observations and Findings

The periodic assessment concluded that the results of their review of the performance of (a)(1) SSCs against established goals indicated that the associated corrective actions had been effective in preventing recurrence of poor performance or functional failures.

For SSCs classified under (a)(2) of the rule, the report indicated that appropriate preventive maintenance activities had been performed to sustain the conclusion that these SSC's were properly classified as meeting the requirements of Paragraph (a)(2) of the rule. The report further stated that the corrective actions for (a)(2) SSCs that were identified as having experienced FFs were reviewed and the corrective actions were determined to be acceptable. However, the report identified an exception to this assertion related to SSCs that had repetitive FFs. Relative to this issue the report stated that CCNPP's program for identifying and evaluating repeat FFs had identified instances where the corrective action program had not have been fully effective in precluding the cause of the failure. The report further stated that instances were identified where several months had elapsed without the development of performance goals for SSCs required to be monitored in accordance with paragraph (a)(1) of the rule. This condition was exemplified by the steam driven auxiliary feed pump trains which had demonstrated poor performance in May of 1996. However, the goals for this system had still not been established seven months later at the conclusion of the periodic assessment. In response to this issue the licensee revised Section 5.5 of Procedure MN-1-112, Managing System Performance, Revision 2, to establish a 60 day time frame for completing the evaluation, corrective action plan and goal setting for an SSC that had exceeded its performance measures.

Nonetheless, the team identified several examples of excessive time periods between the identification of poor system performance or functional failures and the development of appropriate goals. These examples are discussed in detail in Section M1.1 of this report. As determined by the team the identification of this program deficiency in the (a)(3) periodic assessment coupled with the ineffective implementation of corrective actions in response to this issue represented a missed opportunity to correct an adverse finding.

Relative to the use of industry operating experience (IOE), the report stated that for each case where (a)(1) goals had been established for SSCs it had been demonstrated that IOE was appropriately included in the consideration of corrective actions and goal setting. However, as noted in the report, the effectiveness of the use of this required process input was questionable since the primary source of documented information in this area was limited to manufactures and vendors. The report recommended that a more formal method for the inclusion of IOE in the CCNPP Maintenance Rule program should be adopted. Accordingly, the governing controls in Section 5.1 of Procedure MN-1-112, Revision 2, were modified to establish organizational responsibility for the review and incorporation of applicable IOE into CCNPP's maintenance rule program. The team also noted that BG&E's

Industry Experience Assessment Unit had developed a proposed revision to Administrative Procedure NS-1-100, Use of Industry Operating Experience, Revision 2 and a companion desk top instruction, Initial Screening Guideline for Industry event Reports, that provided amplifying information relative to the incorporation of IOE.

The evaluation documented the process where CCNPP relied on the application of the preventive maintenance (PM) optimization program to balance availability and reliability for SSCs that have demonstrated poor performance. This process was emphasized within the MR program documents. Further, the evaluation emphasized the need to continue to specify actions taken to improve or modify the PM program to enhance reliability and should document this activity in the next (a)(3) periodic evaluation.

c. Conclusions

Based on the review of the program documents and portions of the (a)(3) periodic evaluation that addressed balancing, the team noted that, although the performance criteria on a number of SSCs were recently revised, the program adequately implemented balancing availability and reliability. The evaluation reflected a thorough approach and it met the requirements of paragraph (a)(3) of the rule for balancing availability and reliability.

The team also noted that despite the corrective actions associated with improving the timeliness of developing performance goals for SSCs required to be monitored under (a)(1) of the rule, several examples of excessive time periods between the identification of functional failures and the development of appropriate goal were identified by the team. Accordingly, the previous identification of this program deficiency in the (a)(3) periodic assessment coupled with the ineffective implementation of corrective actions in response to this issue represented a missed opportunity to correct an adverse finding.

M1.5 Plant Safety Assessments before Taking Equipment out of Service

a. Scope

The team reviewed BG&E's conduct of on-line maintenance with regard to its impact on the Maintenance Rule and risk assessment. The team also interviewed a number of maintenance, engineering and operations personnel to ascertain their level of knowledge of the Rule and the relation between management of risk of on-line maintenance activities and equipment availability as it related to system performance.

b. Observations and Findings

The team found that BG&E had a good program for the conduct of on-line maintenance. The process was controlled by administrative procedure MN-1-202, "Conduct of Plant Work Control", which described the development and implementation of maintenance activities at Calvert Cliffs. The procedure was detailed and provided clear guidance for assessing the risk associated with taking equipment or entire trains out of service. The use of the plant-specific PRA in planning and scheduling work as part of the quarterly system schedule (QSS) was noteworthy. The team observed that maintenance and operations work control (OWC) personnel were aware of the need to limit equipment outage times to maximize availability, not just to fit into a limiting condition of operation (LCO) window.

The team determined that OWC personnel were knowledgeable of the Maintenance Rule as it applied to their activities. Personnel interviewed indicated that the thought process required of all groups involved in assessing risk, especially for fly-up/emergent work, was well-controlled by the detailed guidance in Attachment 7 to MN-1-202. One OWC operator indicated that the operational risk assessment history (ORAH) sheet, normally attached to the QSS weekly worksheet, was particularly useful for after-hour risk assessments when reliability engineering unit (REU) personnel were not on site. The ORAH contained data on previous Calvert Cliffs' maintenance experiences, as well as industry experience, to define certain risk-acceptable equipment combinations and requirements when determining the acceptability of removing a component from service. The team noted that OWC personnel were not hesitant in referring to the REU for assistance in risk assessment and understood the requirements for additional controls and contingency plans for medium and high risk work. Similar understanding was noted in maintenance and system engineering personnel.

The team conducted a walk-down of some plant systems, and observed that a green signal was posted at the entrance of the building of the SACM EDGs. The signal indicated to the plant staff that the equipment should not be removed from service for maintenance at that time because their unavailability would increase the risk of the plant, given that other maintenance was being carried out.

Additionally, the team noted that a PRA assessment was performed about two and a half weeks before the start of the QSS. Following this evaluation, risk insights were provided for the planning and scheduling of maintenance activities. In addition, a second PRA evaluation was conducted during each week of the QSS to evaluate the risk associated with actual configurations of equipment out-of-service.

c. Conclusions

BG&E had implemented an effective on-line maintenance program, which appropriately considered risk in the planning, scheduling and implementation of QSS work. Personnel interviewed were knowledgeable of the Maintenance Rule and its impact on their activities.

The team verified that the observed plant procedures, practices and parameters were consistent with the CCNPP UFSAR. The team also reviewed SSC descriptions and design functions and identified no discrepancies with the UFSAR.

M3 Staff Knowledge and Performance

a. Inspection Scope

The team interviewed managers, system managers, system engineers, and operations department personnel to assess their understanding of the maintenance rule and their associated responsibilities.

b. Observations and Findings

The team determined that the system managers (SM) and engineers had excellent knowledge of their systems and very good knowledge of the maintenance rule requirements and their associated responsibilities. This was found to be a positive attribute of the program. The team noted that the SMs were in agreement that the new performance criteria being established for their SSCs. The SMs indicated, that they had a direct input in the development of the new criteria and further indicated the new criteria would greatly enhance their ability to implement MR requirements.

The team determined that the SROs and ROs had a basic awareness of the MR requirements and their associated responsibilities. Additionally, the team noted that the plant operators (non-licensed) knowledge of the MR was weak, although they were aware of the need to track and document equipment unavailability time and how to obtain MR information if required. The team also determined that a limited amount (1 to 2 hours) of MR training was given in the last three months and previous training was limited to required reading. The operators have requested more training from this facility to ensure continued or additional understanding of the MR.

In addition, under section M1.5 above the team determined that OWC personnel were knowledgeable of the MR as it applied to their activities.

c. Conclusion

System managers and engineers had excellent knowledge of their systems and very good knowledge of their MR responsibilities. The team determined this was a positive attribute of the program. Operations personnel had a basic understanding of the MR and their responsibilities.

M7 Quality Assurance (QA) Related to Maintenance Activities

M7.1 Self-Assessments of the Maintenance Rule Program

a. Inspection Scope

The team reviewed recent assessments related to the maintenance rule in order to determine if the provisions of the rule were properly implemented.

b. Observations and Findings

The team examined the most recent Nuclear Performance Assessment Department (NPAD) Report, 97-AR-01-EAU, dated October 1, 1997. As a result of this review the team determined that the scope of this assessment was adequate and that the associated recommendations and issue reports were constructive in identifying areas for improvement. Notable among the report findings were that (1) full compliance with the requirements of the maintenance rule may be prevented by the use of a complex reliability index which combines reliability and availability and (2) repetitive functional failures greater than the plant level indicator are not getting appropriate management attention. The team also reviewed another self-assessment report conducted by an outside contractor in May 1996, that recommended that the reliability index should be abandoned in favor of separate availability and reliability indicators. The identification of these significant issues, which were also identified by the team as areas of regulatory noncompliance, represented missed opportunities to self identify and correct fundamental elements associated with the maintenance rule.

c. Conclusions

The Maintenance Rule Assessment Report 97-AR-01-EAU was comprehensive in scope and that the resultant recommendations and Issue Reports identified significant areas for improvement. However, the team determined that BG&E missed opportunities to correct program deficiencies associated with the MR implementation on many of these self-identified items and in particular in resolving the concerns associated with the reliability index and in the timely handling of repetitive functional failures.

Review of Final Safety Analysis Report (FSAR) Commitments

A recent discovery of a licensee operating their facility in a manner contrary to the Updated Final Safety Analysis Report (UFSAR) description highlighted the need for a special focussed review that compares plant practices, procedures, and parameters to the UFSAR descriptions. While performing the inspection discussed in this report, the team reviewed selected portions of the UFSAR. During the detailed system vertical slice reviews, the team noted one problem where information contained in the UFSAR was not current. This example had already been addressed by BG&E during their UFSAR review and was properly captured and dispositioned in issue report (IR) IR3-001-011.

V. Management Meetings

X1 Exit Meeting Summary

The team discussed the progress of the inspection with BG&E representatives on a daily basis and presented the inspection results to members of management at the conclusion of the inspection on April 3, 1998. Additional discussion on the apparent violation occurred on April 22, 1998, led by Mr. Conte of Region I and Mr. Syndor of BG&E.

The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

PARTIAL LIST OF PERSONS CONTACTED

Licensee

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R. Cavedo, Senior Engineer
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J. Stewart, Senior Resident Inspector
F. Bower, Resident Inspector

LIST OF ACRONYMS

CCNPP	Calvert Cliffs Nuclear Power Plant
CDF	Core Damage Frequency
EP	Expert Panel
FF	Functional failures
IPE	Individual Plant Examination
IPEEE	Individual Plant External Events Examination
MR	Maintenance Rule
MRC	Maintenance Rule Coordinator
PC	Performance Criteria
PRA	Probabilistic Risk Assessment
QSS	Quarterly System Schedule
RI	Reliability Index
SSC	Structure, System, and Component

LIST OF INSPECTION PROCEDURES

IP 62706: Maintenance Rule

ITEMS OPENED AND CLOSED

Opened

EEI 50-317(318)/98-04-01	VIO	SSCs within the scope of the Maintenance Rule were permitted to remain under 10 CFR 50.65(a)(2) when preventative maintenance failed to assure that these SSCs remained capable of performing their intended function.
EEI 50-317(318)/98-04-02	VIO	failure to establish performance measures for the emergency diesel generator building heating, ventilation, and air conditioning system.
EEI 50-317(318)/98-04-03	VIO	failure to include the safety related portion of the emergency lighting located outside the control room in the scope of the MR program and 20 SSCs were added to the scope of the rule after initial MR implementation in July, 1996.

Closed

50-317(318)/97-05-01	URI	failure to include the safety related portion of the emergency lighting located outside the control room in the scope of the MR program.

DOCUMENTS REVIEWED OR REFERENCED

- Baltimore Gas and Electric, "Calvert Cliffs Nuclear Power Plant - Individual Plant Examination Summary Report, Volumes 1 and 2", RAN 92-008, Revision 0, December 1993.
- Baltimore Gas and Electric, "Risk Significant Maintenance Rule Systems (Main report with seven attachments, A to G)", RAN 94-006, REV 0, April 1996
- Memorandum from B.B. Mrowca to E.R. Zumwalt (both from Baltimore Gas and Electric), "Function Importance Ranking for updated CDF", RE98-019, March 1998.
- Baltimore Gas and Electric, "Summary of significant Changes to the Model since the IPE: (Item 13)", MR-INPCT.DOC, no date.
- Baltimore Gas and Electric, "Maintenance Rule Indicator - (a)(1) Systems", March 1998.
- NPAD Assessment Report, 97-AR-01-EAU, Maintenance Rule, known as "Self-Assessment Report". Includes review of the performance criteria at CCNPP by D.H. Worledge (July, 1997) as Attachment B.
- Baltimore Gas and Electric, "Managing System Performance", Administrative Procedure MN-1-112, Revision 2.
- Baltimore Gas and Electric, "Conduct of Plant Work Control", Administrative Procedure MN-1-202, Revision 11, March 1998.
- Baltimore Gas and Electric, Reliability Engineering, "Maintenance Rule 120V Vital AC System Performance Indicator Bases Document", Attachment 11, RAN 96-001, Rev. 3, March 1998.
- Baltimore Gas and Electric, Reliability Engineering, "Risk Significant Components - Component Cooling System", RAN 98-004C, Rev. 0, March 1998.
- Baltimore Gas and Electric, Reliability Engineering, "Risk Significant Components - Compressed Air System", RAN 98-004M, Rev. 0, March 1998.
- Baltimore Gas and Electric, Reliability Engineering, "SRW/CC Leakage Performance Indicator", RAN 98-008, Rev. 0, December 1994.
- Baltimore Gas and Electric, Reliability Engineering, "AFW System Performance Indicator and Criteria", RAN 97-046, Rev. 0, March 1998.
- Baltimore Gas and Electric, "Maintenance Rule Scoping Document", March 1998.
- Baltimore Gas and Electric, "March 3, 1998 Maintenance Rule Expert Panel Meeting Minutes". (and additional EP meeting minutes)

- Nuclear Energy Institute, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants", NUMARC 93-01, Revision 2, April 1996.

- J. Gisclon and D. Worledge, "Monitoring Reliability for the Maintenance Rule", EPRI Technical Bulletin 96-11-01, November 1996.